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Network Working Group
Request for Comments: 840

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Official Protocols

This RFC identifies the documents specifying the official protocols used in the Internet. Annotations identify any revisions or changes planned.

To first order, the official protocols are those in the Internet Protocol Transition Workbook (IPTW) dated March 1982. There are several protocols in use that are not in the IPTW. A few of the protocols in the IPTW have been revised these are noted here. In particular, the mail protocols have been revised and issued as a volume titled "Internet Mail Protocols" dated November 1982. There is a volume of protocol related information called the Internet Protocol Implementers Guide (IPIG) dated August 1982. A few of the protocols (in particular the Telnet Options) have not been revised for many years, these are found in the old ARPANET Protocol Handbook (APH) dated January 1978.

This document is organized as a sketchy outline. The entries are protocols (e.g., Transmission Control Protocol). In each entry there are notes on status, specification, comments, other references, dependencies, and contact.

The status is one of: required, recommended, elective, or experimental.

The specification identifies the protocol defining documents.

The comments describe any differences from the specification or problems with the protocol.

The other references identify documents that comment on or expand on the protocol.

The dependencies indicate what other protocols are called upon by this protocol.

The contact indicates a person who can answer questions about the protocol.

In particular, the status may need some further clarification:

required

- all hosts must implement the required protocol,

recommended

- all hosts are encouraged to implement the recommended protocol,

elective

- hosts may implement or not the elective protocol,

experimental

- hosts should not implement the experimental protocol unless they are participating in the experiment and have coordinated their use of this protocol with the contact person, and

none

- this is not a protocol.

Overview

Catenet Model

STATUS: None

SPECIFICATION: IEN 48 (in IPTW)

COMMENTS:

Gives an overview of the organization and principles of the Internet.

Could be revised and expanded.

OTHER REFERENCES:

DEPENDENCIES:

CONTACT: Postel@USC-ISIF

Network Level

Internet Protocol (IP)

STATUS: Required

SPECIFICATION: RFC 791 (in IPTW)

COMMENTS:

A few minor problems have been noted in this document.

The most serious is a bit of confusion in the route options. The route options have a pointer that indicates which octet of the route is the next to be used. The confusion is between the phrases "the pointer is relative to this option" and "the smallest legal value for the pointer is 4". If you are confused, forget about the relative part, the pointer begins at 4.

Another important point is the alternate reassembly procedure suggested in RFC 815.

Note that ICMP is defined to be an integral part of IP. You have not completed an implementation of IP if it does not include ICMP.

OTHER REFERENCES:

RFC 815 (in IPIG) - IP Datagram Reassembly Algorithms

RFC 814 (in IPIG) - Names, Addresses, Ports, and Routes

RFC 816 (in IPIG) - Fault Isolation and Recovery

RFC 817 (in IPIG) - Modularity and Efficiency in Protocol Implementation

DEPENDENCIES:

CONTACT: Postel@USC-ISIF

Internet Control Message Protocol (ICMP)

STATUS: Required

SPECIFICATION: RFC 792 (in IPTW)

COMMENTS:

A few minor errors in the document have been noted. Suggestions have been made for additional types of redirect message and additional destination unreachable messages.

OTHER REFERENCES:

DEPENDENCIES: Internet Protocol

CONTACT: Postel@USC-ISIF

Host Level

User Datagram Protocol (UDP)

STATUS: Recommended

SPECIFICATION: RFC 768 (in IPTW)

COMMENTS:

The only change noted for the UDP specification is a minor clarification that if in computing the checksum a padding octet is used for the computation it is not transmitted or counted in the length.

OTHER REFERENCES:

DEPENDENCIES: Internet Protocol

CONTACT: Postel@USC-ISIF

Transmission Control Protocol (TCP)

STATUS: Recommended

SPECIFICATION: RFC 793 (in IPTW)

COMMENTS:

Many comments and corrections have been received for the TCP specification document. These are primarily document bugs rather than protocol bugs.

Event Processing Section: There are many minor corrections and clarifications needed in this section.

Push: There are still some phrases in the document that give a "record mark" flavor to the push. These should be further clarified. The push is not a record mark.

Listening Servers: Several comments have been received on difficulties with contacting listening servers. There should be some discussion of implementation issues for servers, and some notes on alternative models of system and process organization for servers.

Maximum Segment Size: The maximum segment size option should be generalized and clarified. It can be used to either increase or decrease the maximum segment size from the default. The default should be established more clearly. The default is based on the default maximum Internet Datagram size which is 576 octets counting the IP and TCP headers. The option counts only the segment data. For each of IP and TCP the minimum header is 20 octets and the maximum header is 60 octets. So the default maximum data segment is could be anywhere from 456 to 536 octets. The current proposal is to set it at 536 data octets.

Idle Connections: There have been questions about automatically closing idle connections. Idle connections are ok, and should not be closed. There are several cases where idle connections arise, for example, in Telnet when a user is thinking for a long time following a message from the server computer before his next input. There is no TCP "probe" mechanism, and none is needed.

Queued Receive Data on Closing: There are several points where it is not clear from the description what to do about data received by the TCP but not yet passed to the user, particularly when the connection is being closed. In general,

the data is to be kept to give to the user if he does a RECV call.

Out of Order Segments: The description says that segments that arrive out of order, that is, are not exactly the next segment to be processed, may be kept on hand. It should also point out that there is a very large performance penalty for not doing so.

User Time Out: This is the time out started on an open or send call. If this user time out occurs the user should be notified, but the connection should not be closed or the TCB deleted. The user should explicitly ABORT the connection if he wants to give up.

OTHER REFERENCES:

RFC 813 (in IPIG) - Window and Acknowledgement Strategy in TCP

RFC 814 (in IPIG) - Names, Addresses, Ports, and Routes

RFC 816 (in IPIG) - Fault Isolation and Recovery

RFC 817 (in IPIG) - Modularity and Efficiency in Protocol Implementation

DEPENDENCIES: Internet Protocol

CONTACT: Postel@USC-ISIF

Host Monitoring Protocol (HMP)

STATUS: Elective

SPECIFICATION: IEN 197

COMMENTS:

This is a good tool for debuging protocol implementations in small remotely located computers.

This protocol is used to monitor Internet gateways and the TACs.

OTHER REFERENCES:

DEPENDENCIES: Internet Protocol

CONTACT: Hinden@BBN-UNIX

Cross Net Debugger (XNET)

STATUS: Elective

SPECIFICATION: IEN 158

COMMENTS:

This specification should be updated and reissued as an RFC.

OTHER REFERENCES:

RFC 643

DEPENDENCIES: Internet Protocol

CONTACT: Postel@USC-ISIF

Exterior Gateway Protocol (EGP)

STATUS: Experimental

SPECIFICATION: RFC 827

COMMENTS:

Please discuss any plans for implementation or use of this protocol with the contact.

OTHER REFERENCES:

DEPENDENCIES: Internet Protocol

CONTACT: Postel@USC-ISIF

Gateway Gateway Protocol (GGP)

STATUS: Experimental

SPECIFICATION: RFC 823

COMMENTS:

Please discuss any plans for implementation or use of this protocol with the contact.

OTHER REFERENCES:

DEPENDENCIES: Internet Protocol

CONTACT: Brescia@BBN-UNIX

Multiplexing Protocol

STATUS: Experimental

SPECIFICATION: IEN 90

COMMENTS:

No current experiment in progress. There is some question as to the extent to which the sharing this protocol envisions can actually take place. Also, there are some issues about the information captured in the multiplexing header being (a) insufficient, or (b) over specific.

Please discuss any plans for implementation or use of this protocol with the contact.

OTHER REFERENCES:

DEPENDENCIES: Internet Protocol

CONTACT: Postel@USC-ISIF

Stream Protocol (ST)

STATUS: Experimental

SPECIFICATION: IEN 119

COMMENTS:

The implementation of this protocol has evolved and may no longer be consistent with this specification. The document should be updated and issued as an RFC.

Please discuss any plans for implementation or use of this protocol with the contact.

OTHER REFERENCES:

DEPENDENCIES: Internet Protocol

CONTACT: Forgie@BBN

Network Voice Protocol (NVP-II)

STATUS: Experimental

SPECIFICATION: RFC xxx

COMMENTS:

The specification is an ISI Internal Memo which should be updated and issued as an RFC.

Please discuss any plans for implementation or use of this protocol with the contact.

OTHER REFERENCES:

DEPENDENCIES: Internet Protocol, Stream Protocol

CONTACT: Casner@USC-ISIB

Application Level

Telnet Protocol (TELNET)

STATUS: Recommended

SPECIFICATION: RFC 764 (in IPTW)

COMMENTS:

A few minor typographical errors should be corrected and some clarification of the SYNCH mechanism should be made.

OTHER REFERENCES:

DEPENDENCIES: Transmission Control Protocol

CONTACT: Postel@USC-ISIF

Telnet Options (TELNET)

Number	Name	RFC	NIC	APH	USE
0	Binary Transmission	...	15389	yes	yes
1	Echo	...	15390	yes	yes
2	Reconnection	...	15391	yes	no
3	Suppress Go Ahead	...	15392	yes	yes
4	Approximate Message Size Negotiation	...	15393	yes	no
5	Status	651	31154	yes	yes
6	Timing Mark	...	16238	yes	yes
7	Remote Controlled Trans and Echo	726	39237	yes	no
8	Output Line Width	...	20196	yes	no
9	Output Page Size	...	20197	yes	no
10	Output Carriage-Return Disposition	652	31155	yes	no
11	Output Horizontal Tabstops	653	31156	yes	no
12	Output Horizontal Tab Disposition	654	31157	yes	no
13	Output Formfeed Disposition	655	31158	yes	no
14	Output Vertical Tabstops	656	31159	yes	no
15	Output Vertical Tab Disposition	657	31160	yes	no
16	Output Linefeed Disposition	658	31161	yes	no
17	Extended ASCII	698	32964	yes	no
18	Logout	727	40025	yes	no
19	Byte Macro	735	42083	yes	no
20	Data Entry Terminal	732	41762	yes	no
21	SUPDUP	734 736	42213	yes	no
22	SUPDUP Output	749	45449	no	no
23	Send Location	779	-----	no	no
255	Extended-Options-List	...	16239	yes	yes

STATUS: Elective

SPECIFICATION: (in APH)

COMMENTS:

There is an open question about some of these. Most of the options are implemented by so few hosts that perhaps they should be eliminated. These should all be studied and the useful ones reissued as RFCs.

The last column (USE) of the table above indicates which options are in general use.

The following are recommended: Binary Transmission, Echo, Suppress Go Ahead, Status, Timing Mark, and Extended Options List.

Many of these must be revised for use with TCP.

OTHER REFERENCES:

DEPENDENCIES: Telnet

CONTACT: Postel@USC-ISIF

File Transfer Protocol (FTP)

STATUS: Recommended

SPECIFICATION: RFC 765 (in IPTW)

COMMENTS:

There are a number of minor corrections to be made. A major change is the deletion of the mail commands, and a major clarification is needed in the discussion of the management of the data connection. Also, a suggestion has been made to include some directory manipulation commands (RFC 775).

Eventhough the MAIL features are defined in this document, they are not to be used. The SMTP protocol is to be used for all mail service in the Internet.

Data Connection Management:

a. Default Data Connection Ports: All FTP implementations must support use of the default data connection ports, and only the User-PI may initiate the use of non-default ports.

b. Negotiating Non-Default Data Ports: The User-PI may specify a non-default user side data port with the PORT command. The User-PI may request the server side to identify a non-default server side data port with the PASV command. Since a connection is defined by the pair of addresses, either of these actions is enough to get a different data connection, still it is permitted to do both commands to use new ports on both ends of the data connection.

c. Reuse of the Data Connection: When using the stream mode of data transfer the end of the file must be indicated by closing the connection. This causes a problem if multiple files are to be transfered in the session, due to need for TCP to hold the connection record for a time out period to guarantee the reliable communication. Thus the connection can not be reopened at once.

There are two solutions to this problem. The first is to negotiate a non-default port (as in (b) above). The second is to use another transfer mode.

A comment on transfer modes. The stream transfer mode is inherently unreliable, since one can not determine if the connection closed prematurely or not. The other transfer modes (Block, Compressed) do not close the connection to indicate the end of file. They have enough FTP encoding that the data connection can be parsed to determine the end of the file. Thus using these modes one can leave the data connection open for multiple file transfers.

Why this was not a problem with the old NCP FTP:

The NCP was designed with only the ARPANET in mind. The ARPANET provides very reliable service, and the NCP counted on it. If any packet of data from an NCP connection were lost or damaged by the network the NCP could not recover. It is a tribute to the ARPANET designers that the NCP FTP worked so well.

The TCP is designed to provide reliable connections over many different types of networks and interconnections of networks. TCP must cope with a set of networks that can not promise to work as well as the ARPANET. TCP must make its own provisions for end-to-end recovery from lost or damaged packets. This leads to the need for the connection phase-down time-out. The NCP never had to deal with acknowledgements or retransmissions or many other

things the TCP must do to make connection reliable in a more complex world.

LIST and NLST:

There is some confusion about the LIST an NLST commands, and what is appropriate to return. Some clarification and motivation for these commands should be added to the specification.

OTHER REFERENCES:

RFC 678 - Document File Format Standards

DEPENDENCIES: Transmission Control Protocol

CONTACT: Postel@USC-ISIF

Trivial File Transfer Protocol (TFTP)

STATUS: Elective

SPECIFICATION: RFC 783 (in IPTW)

COMMENTS:

No known problems with this specification. This is in use in several local networks.

OTHER REFERENCES:

DEPENDENCIES: User Datagram Protocol

CONTACT: Postel@USC-ISIF

Simple Mail Transfer Protocol (SMTP)

STATUS: Recommended

SPECIFICATION: RFC 821

COMMENTS:

This has been revised since the IPTW, it is in the "Internet Mail Protocols" volume of November 1982. RFC 788 (in IPTW) is obsolete.

There have been many misunderstandings and errors in the early

implementations. Some documentation of these problems can be found in the file [ISIF]<SMTP>MAIL.ERRORS.

Some minor differences between RFC 821 and RFC 822 should be resolved.

OTHER REFERENCES:

RFC 822 - Mail Header Format Standards

This has been revised since the IPTW, it is in the "Internet Mail Protocols" volume of November 1982. RFC 733 (in IPTW) is obsolete. Further revision of RFC 822 is needed to correct some minor errors in the details of the specification.

DEPENDENCIES: Transmission Control Protocol

CONTACT: Postel@USC-ISIF

Remote Job Entry (RJE)

STATUS: Elective

SPECIFICATION: RFC 407 (in APH)

COMMENTS:

Some changes needed for use with TCP.

No known active implementations.

OTHER REFERENCES:

DEPENDENCIES: File Transfer Protocol
Transmission Control Protocol

CONTACT: Postel@USC-ISIF

Remote Job Service (NETRJS)

STATUS: Elective

SPECIFICATION: RFC 740 (in APH)

COMMENTS:

Used with the UCLA IBM OS system.

Please discuss any plans for implementation or use of this protocol with the contact.

Revision in progress.

OTHER REFERENCES:

DEPENDENCIES: Transmission Control Protocol

CONTACT: Braden@USC-ISIA

Remote Telnet Service

STATUS: Elective

SPECIFICATION: RFC 818

COMMENTS:

OTHER REFERENCES:

DEPENDENCIES: Telnet, Transmission Control Protocol

CONTACT: Postel@USC-ISIF

Graphics Protocol

STATUS: Elective

SPECIFICATION: NIC 24308 (in APH)

COMMENTS:

Very minor changes needed for use with TCP.

No known active implementations.

OTHER REFERENCES:

DEPENDENCIES: Telnet, Transmission Control Protocol

CONTACT: Postel@USC-ISIF

Echo Protocol

STATUS: Recommended

SPECIFICATION: RFC 347

COMMENTS:

This specification should be revised for use with TCP and reissued.

OTHER REFERENCES:

DEPENDENCIES: Transmission Control Protocol
or User Datagram Protocol

CONTACT: Postel@USC-ISIF

Discard Protocol

STATUS: Elective

SPECIFICATION: RFC 348

COMMENTS:

This specification should be revised for use with TCP and reissued.

OTHER REFERENCES:

DEPENDENCIES: Transmission Control Protocol
or User Datagram Protocol

CONTACT: Postel@USC-ISIF

Character Generator Protocol

STATUS: Elective

SPECIFICATION: RFC 429

COMMENTS:

This specification should be revised for use with TCP and reissued.

OTHER REFERENCES:

DEPENDENCIES: Transmission Control Protocol
or User Datagram Protocol

CONTACT: Postel@USC-ISIF

Quote of the Day Protocol

STATUS: Elective

SPECIFICATION: RFC xxx

COMMENTS:

Open a connection to this server, it sends you a quote (as a character string), and closes the connection. This should be described in an RFC.

OTHER REFERENCES:

DEPENDENCIES: Transmission Control Protocol
or User Datagram Protocol

CONTACT: Postel@USC-ISIF

Active Users Protocol

STATUS: Elective

SPECIFICATION: RFC xxx

COMMENTS:

Open a connection to this server, it sends you a list of the currently logged in users (as a character string), and closes the connection. This should be described in an RFC.

OTHER REFERENCES:

DEPENDENCIES: Transmission Control Protocol
or User Datagram Protocol

CONTACT: Postel@USC-ISIF

Finger Protocol

STATUS: Elective

SPECIFICATION: RFC 742 (in APH)

COMMENTS:

Some extensions have been suggested.

Some changes are are needed for TCP.

OTHER REFERENCES:

DEPENDENCIES: Transmission Control Protocol

CONTACT: Postel@USC-ISIF

NICNAME Protocol

STATUS: Elective

SPECIFICATION: RFC 812 (in IPTW)

COMMENTS:

Accesses the ARPANET Directory database.

OTHER REFERENCES:

DEPENDENCIES: Transmission Control Protocol

CONTACT: Feinler@SRI-NIC

HOSTNAME Protocol

STATUS: Elective

SPECIFICATION: RFC 811 (in IPTW)

COMMENTS:

Accesses the Registered Internet Hosts database (HOSTS.TXT).

OTHER REFERENCES:

RFC 810 - Host Table Specification

DEPENDENCIES: Transmission Control Protocol

CONTACT: Feinler@SRI-NIC

Host Name Server Protocol

STATUS: Experimental

SPECIFICATION: IEN 116 (in IPTW)

COMMENTS:

This specification has significant problems: 1) The name syntax is out of date. 2) The protocol details are ambiguous, in particular, the length octet either does or doesn't include itself and the op code. 3) The extensions are not supported by any known implementation.

Work is in progress on a significant revision. Further implementations of this protocol are not advised.

Please discuss any plans for implementation or use of this protocol with the contact.

OTHER REFERENCES:

DEPENDENCIES: User Datagram Protocol

CONTACT: Postel@USC-ISIF

CSNET Mailbox Name Server Protocol

STATUS: Experimental

SPECIFICATION: CS-DN-2

COMMENTS:

Please discuss any plans for implementation or use of this protocol with the contact.

OTHER REFERENCES:

DEPENDENCIES: Transmission Control Protocol

CONTACT: Solomon@UWISC

Daytime Protocol

STATUS: Elective

SPECIFICATION: RFC xxx

COMMENTS:

Open a connection to this server, it sends you the date and time (as a character string), and closes the connection. This should be described in an RFC.

OTHER REFERENCES:

DEPENDENCIES: Transmission Control Protocol
or User Datagram Protocol

CONTACT: Postel@USC-ISIF

Time Server Protocol

STATUS: Recommended

SPECIFICATION: IEN 142

COMMENTS:

Open a connection to this server, it sends you the date and time (as a 32-bit number), and closes the connection. Or send a user datagram and it send back a datagram containing the date and time (as a 32-bit number).

No known problems. Specification should be reissued as an RFC.

OTHER REFERENCES:

DEPENDENCIES: Transmission Control Protocol
or User Datagram Protocol

CONTACT: Postel@USC-ISIF

DCNET Time Server Protocol (Internet Clock Service)

STATUS: Elective

SPECIFICATION: RFC 778

COMMENTS:

OTHER REFERENCES:

DEPENDENCIES: Internet Control Message Protocol

CONTACT: Mills@LINKABIT-DCN6

SUPDUP Protocol

STATUS: Elective

SPECIFICATION: RFC 734 (in APH)

COMMENTS:

OTHER REFERENCES:

DEPENDENCIES: Transmission Control Protocol

CONTACT: Admin.MRC@SU-SCORE

Internet Message Protocol (MPM)

STATUS: Experimental

SPECIFICATION: RFC 753

COMMENTS:

This is an experimental multimedia mail transfer protocol. The implementation is called a Message Processing Module or MPM.

Please discuss any plans for implementation or use of this protocol with the contact.

OTHER REFERENCES:

RFC 767 - Structured Document Formats

DEPENDENCIES: Transmission Control Protocol

CONTACT: Postel@USC-ISIF

Appendices

Assigned Numbers

STATUS: None

SPECIFICATION: RFC 820

COMMENTS:

Describes the fields of various protocols that are assigned specific values for actual use, and lists the currently assigned values.

Issued January 1983, replaces RFC 790 in IPTW.

OTHER REFERENCES:

CONTACT: Postel@USC-ISIF

Pre-emption

STATUS: Elective

SPECIFICATION: RFC 794 (in IPTW)

COMMENTS:

Describes how to do pre-emption of TCP connections.

OTHER REFERENCES:

CONTACT: Postel@USC-ISIF

Service Mappings

STATUS: None

SPECIFICATION: RFC 795 (in IPTW)

COMMENTS:

Describes the mapping of the IP type of service field onto the parameters of some specific networks.

Out of date, needs revision.

OTHER REFERENCES:

CONTACT: Postel@USC-ISIF

Address Mappings

STATUS: None

SPECIFICATION: RFC 796 (in IPTW)

COMMENTS:

Describes the mapping of the IP address field onto the address field of some specific networks.

Out of date, needs revision.

OTHER REFERENCES:

CONTACT: Postel@USC-ISIF